

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference 3594PTWO/AG/la	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/EP 03/09436	International filing date (day/month/year) 26.08.2003	Priority date (day/month/year) 27.08.2002
International Patent Classification (IPC) or both national classification and IPC B22D11/06		
Applicant DANIELI & C. OFFICINE MECCANICHE S.p.A. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.  
  
☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
  
 These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand  25.03.2004	Date of completion of this report  21.09.2004
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Flink, E  Telephone No. +49 89 2399-2919  

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP 03/09436

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-11 as originally filed

**Claims, Numbers**

1-20 received on 02.09.2004 with letter of 30.08.2004

**Drawings, Sheets**

1/10-10/10 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-14,17,18
	No: Claims	15,16,19,20
Inventive step (IS)	Yes: Claims	1-14
	No: Claims	15-20
Industrial applicability (IA)	Yes: Claims	1-20
	No: Claims	

2. Citations and explanations

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Reference is made to the following document:

D1: US-A-5915454

2. The object of the invention is to provide a continuous casting machine for metallic products comprising a molten metal containment device between the crystallising rollers of said casting machine, which allows the horizontal pivoting of the liquid bath confinement plates present and simplifying the cooling and lubrication of the articulated joint which allows such horizontal pivoting (see page 1, line 35 - page 2, line 2).

This object is achieved with the continuous casting machine of the independent claims 1 and 15.

3. The documents cited in the International Search Report (ISR) do not disclose a continuous casting machine having all the features of the subject-matter of the independent claim 1; in particular they do not mention a flexible connecting element able to sustain the lateral containment plate allowing the horizontal pivoting at least around an axis of pivoting horizontal and substantially normal to the axes of rotation of the crystallising rollers.

Further, the documents cited in the ISR do not give any indication that the above mentioned object can be achieved with such a continuous casting machine.

Therefore the subject-matter of claim 1 is novel and involves an inventive step and meets the requirements of Articles 33(2) and 33(3) PCT.

The dependent claims 2-14 relate to further embodiments of the subject-matter of claim 1 and meet likewise the requirements of Articles 33(2) and 33(3) PCT.

4. A continuous casting machine for metallic products, comprising a molten metal containment device between the crystallising rollers of said casting machine, and having all the constructional features of the subject-matter of claim 15 is already disclosed in document D1 (see col.2, line 31 - col.3, line 52 and Figures 1-3). Therefore, the subject-matter of claim 15 lacks novelty (Article 33(2) PCT).

The features of claims 16, 19 and 20 are also disclosed in D1 (see the above

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mentioned passage and Figures).

Therefore, the subject-matter of said claims also lacks novelty (Article 33(2) PCT).

The features of claims 17 and 18 are either derivable from D1 or come further within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can readily be contemplated in advance.

Consequently, the subject-matter of said claims does not involve an inventive step (Article 33(3) PCT).

### New Claims

- 1) A continuous casting machine for metallic products comprising a molten metal containment device between the crystallising rollers (38, 39) of said casting machine, where said crystallising rollers (38, 39) are able to rotate around two  
5 axes (A1, A2) substantially horizontal, and are placed in positions such as to define between them a zone of minimal distance (50) between the surfaces of said crystallising rollers (38, 39) and so to allow, in the space above said zone of minimal distance (50), the accumulation of a molten metal bath poured from a tundish or other means of distribution, each of said crystallising rollers (38, 39)  
10 comprising one or more shoulder surfaces (40, 41) lying in a plane normal to the axis of rotation (A1, A2) of said crystallising roller (38, 39), said containment device comprising, on each side of said crystallising rollers (38, 39)
- a lateral containment plate (47) able to fit tightly against at least part of each of said shoulder surfaces (40, 41) of said crystallising rollers (38, 39) so as to contain  
15 said molten metal bath;
  - means of providing pressure (37) able to move said lateral containment plate (47) so as to bring it close to and hold it tightly against said shoulder surfaces (40, 41) of both said crystallising rollers (38, 39) and/or remove said lateral containment plate (47) from both said shoulder surfaces (40, 41) of said  
20 crystallising rollers;
- where said lateral containment plate (47) is fixed to said means of providing pressure (37) through an articulated joint,  
said containment device being characterised by the fact that  
said articulated joint comprises a flexible connecting element (1) able to sustain  
25 said lateral containment plate (47) allowing the horizontal pivoting at least around an axis of pivoting (X) horizontal and substantially normal to said axes of rotation (A1, A2) of said crystallising rollers (38, 39).
- 2) The containment device according to claim 1, wherein said flexible connecting element (1) comprises a flexible tubular sleeve.
- 30 3) The containment device according to claim 2, wherein said flexible tubular sleeve (1) comprising one or more corrugated walls like a bellows able to allow

said horizontal pivoting of said containment plate (37) at least around said axes of pivoting (X).

4) The device according to claims 2 and/or 3, wherein said flexible tubular sleeve (1) is connected to said means of providing pressure (37) and to said lateral containment plate (47) in such a way, and has such flexibility, to sustain the latter functioning substantially as a cantilever shelf.

5) The device according to one or more of the claims from 2 to 4, wherein said flexible tubular sleeve (1) has the shape such as to be part of a route for a cooling fluid able to cool at least said one or more walls of said flexible tubular sleeve (1).

6) The device according to claim 5, wherein it comprises an internal body (5) of shape such, and placed inside said flexible tubular sleeve (1) in a way such, to define one or more internal spaces between said internal body (5) and the internal wall(s) of said flexible tubular sleeve (1), where said one or more internal spaces are part of said route for a cooling fluid.

7) The device according to claim 6, wherein said internal body comprises lateral surfaces of shape and dimensions such that each point of said lateral surface is found substantially at a distance, from the closest point of the internal walls of said flexible tubular sleeve (1), when said flexible tubular sleeve (1) is in undeformed conditions, never less than a predetermined minimal distance (H) and that said flexible tubular sleeve (1) comprising one or more nervatures (13a, 13b, 13c, 13d) which surround the transversal sections of said flexible tubular sleeve (1), and one or more grooves (11a, 11b, 11c, 11d) interposed between two of said circular nervatures (13a, 13b, 13c, 13d).

8) The device according to claim 7, wherein said nervatures (13a, 13b, 13c, 13d) are at least two, have circular shape and are closed on themselves, said one or more grooves (11a, 11b, 11c, 11d) have circular shape closed on themselves and said external surfaces of said internal body (5) comprises one or more notched areas (10a, 10b, 10c, 10d), each of which has a surface of shape and dimensions such that each point of it is found substantially at a distance, from the closet point of the internal walls of said undeformed flexible tubular sleeve (1), greater than said predetermined minimal distance (H), so as to assist the flow of said cooling fluid from a cavity below a first of said circular nervatures (13a, 13b, 13c) to the

cavity below a second of said circular nervatures (13b, 13c, 13d) closer to the outlet of the cooling circuit.

9)The device according to claim 8, wherein said external surface of said internal body (5) comprising a plurality of notched areas (10a, 10b, 10c, 10d) placed to form two groups, where each of said two groups is found to the side of said external surfaces opposite with respect to the side on which is found the other of said two groups:

10)The device according to claims 8 and/or 9, wherein said internal body said one or more notched areas (10a, 10b, 10c, 10d) have substantially oblong shape and are located substantially parallel to the closest of said one or more grooves ( 11a, 11b, 11c, 11d) of said flexible tubular sleeve (1).

11)The device according to one or more claims from 5 to 10, wherein each of said internal spaces between said tubular sleeve (1) and said internal body (5) is closed close to one end of said sleeve by a wall (9), and in said walls are etched one or more apertures (14), located around said flexible tubular sleeve (1) and able to allow the flow of said refrigerant liquid from said flexible tubular sleeve (1).

12)The device according to one or more of the claims from 6 to 11, wherein that said internal body (5) has shape and dimensions such, and said flexible tubular sleeve (1) is connected to said means of providing pressure (37) and to said lateral containment plate (47) in a way such, and has shape, dimensions and such flexibility, that said internal body (5) and said flexible tubular sleeve (1) during normal functioning do not come into contact with each other even under the effect of the weight of said lateral containment plate (47) and the support (2) onto which said plate (47) is optionally fixed, even due to the effect of said horizontal pivoting due to the geometric imperfections of said crystallising rollers (38, 39).

13)The device according to one or more of the preceding claims, wherein it comprises means for the measurement of the pressure of said cooling fluid inside said internal space, and means for the control of said pressure of said cooling fluid, able to control the pushing of said lateral containment plate (47) against said crystallising rollers (38, 39) on the basis of said pressure of cooling fluid inside said internal space.



14) The device according to one or more of the preceding claims, wherein it comprises one or more mechanical butts (160) able to limit said horizontal pivoting of said containment plate (47).

15) A molten metal containment device between the crystallising rollers (38, 39) of a continuous casting machine for metallic products, where said crystallising rollers (38, 39) are able to rotate around two substantially horizontal axes (A1, A2), and are located in positions such as to define between them a zone of minimal distance (50) between the surfaces of said crystallising rollers (38, 39) and to allow, in the space above said zone of minimal distance (50), the accumulation of a molten metal bath poured from a tundish or from other means of distribution, each of said crystallising rollers (38, 39) comprising one or more shoulder surfaces (40, 41) lying in a plane normal to the axis of rotation of said crystallising roller (38, 39), said containment device comprising, on each side of said crystallising rollers (38, 39)

- a lateral containment plate (47) able to fit tightly against at least part of said shoulder surfaces (40, 41) of both of said crystallising rollers (38, 39) so as to contain said molten metal bath;

- means of providing pressure (37) able to move said lateral containment plate (47) so as to move it close to and press it against said shoulder surfaces (40, 41) of both said crystallising rollers (38, 39) and/or remove said lateral containment plate (47) of said shoulder surfaces (40, 41) of both of said crystallising rollers; said lateral containment plate (47) is fixed to said means of providing pressure (37) through a plurality of supports (20) able to sustain the weight at least of said lateral containment plate (47), where each of said supports (20) is able to apply onto said lateral containment plate (47) a force with at least a horizontal component, said plurality of supports being placed in a way such that at least one of said supports (20) is positioned at a greater height than the other of said supports (20).

16) The device according to claim 15, wherein said supports (20) are at least three in number placed to form a triangle.

17) The device according to the claims 15 and/or 16, wherein said triangle has height equal to at least 20-30% of the height of said containment plate (47).

18) The device according to one or more of the claims from 15 to 17, wherein said triangle has width, according to a horizontal coordinate, equal to at least 20% of the width of said containment plate (47).

5 19) The device according to one or more of the claims from 15 to 18, wherein each of said supports (20) comprises a cursor (22) fixed onto a first support (2) on which in turn is fixed said lateral containment plate (47), and a tubular sleeve (21), fixed onto a second support (3) fixed in turn onto said means of providing pressure (37), said cursor (22) being fixed to said sleeve (21) in a way allowing it to move with respect to it.

10 20) The device according to one or more of the claims from 15 to 19, wherein each of said supports (20) comprises a spring (23) able to apply an at least horizontal force on said cursor (22).